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THE LONGITUDINAL STUDY OF ASTRONAUT HEALTH

# Newsletter

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## LSAH Improves Collection of Comparison Participants' Data

By **DENISE PATTERSON**  
LSAH Data Manager

Following recommendations from the Institute of Medicine (see the complete report, *Review of NASA's Longitudinal Study of Astronaut Health*, Longnecker, D. E.; Manning, F. J.; Worth, Jr., M. H., Eds.; National Academies Press: Washington, DC, 2004), LSAH has initiated some changes to improve collection of comparison participants' data. Along with their physical examination, comparison participants will be offered a comprehensive laboratory analysis. A new procedure, a bone densitometry measurement using dual X-

ray absorptiometry (DXA scan), will also be added, scheduled every 2-4 years.

If a comparison participant is unable to return to the Johnson Space Center (JSC), LSAH will cover the cost to have the physical exam completed by the participant's primary care physician. This includes the co-pay and costs of any tests that are not covered by the participant's health insurance. The participant should request a disclosure of information form (Privacy Act Disclosure Authorization and Accounting Record, aka DAAR) and reimbursement forms from the LSAH office after scheduling an appointment with his or her physician. A list of the

tests that are part of the LSAH protocol will be provided so that the participant can request the same set of tests from his or her primary care provider. The protocol includes a comprehensive laboratory profile. Reimbursement will only be issued upon receiving the results of the participant's annual examination. Those test results or reports may be faxed to the LSAH office to expedite the reimbursement. The usual turn-around for reimbursement is 10-15 days after receipt of original receipts and results of the physical examination. The LSAH office fax number is 281-483-1220. For more information regarding this process, please contact Denise Patterson, Wyle Laboratories, at 281-244-5195. ■

## Interpreting Medical Research

By **BABY DJOJONEGORO, MS, MPH**

It seems as if medical breakthroughs happen every week, with reports in print media or aired on television describing the latest treatment or cure for various diseases ailing us. Yet we often hear of follow-up studies which either contradict the previous results or show harmful side-effects of previously recommended treatments. How are we to

make sense of this seemingly conflicting information?

As with any type of research, one study alone will not yield the definite answer to the question. The reproduction of results by other researchers is the first step in building a body of evidence in addressing a specific issue. Each study investigating this issue contributes some information to it, so the more studies there are, the stronger

the evidence. However, reporting in mass media is geared to capture events, such as a new study, and not to maintaining a narrative. Therefore, we can not follow the progress of research and are sometimes surprised when the results of the latest big study do not agree with our previous understanding of the issue. Once we keep in mind this need to reserve judgment until

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# Hearing Loss among LSAH Participants

By **RICHARD W. DANIELSON, PhD**  
JSC Manager for Audiology and  
Hearing Conservation

Noise is one of the most common causes of hearing loss, and noise-induced hearing loss (NIHL) is the most common occupational illness in the United States. The effects of noise on hearing are often underestimated because the damage takes place so gradually, without pain, and cannot be visibly detected because the delicate inner ear is buried deep in the skull. Audiometric testing, using pure tone stimuli, has been the traditional method of monitoring hearing loss. Hearing tests have always been part of NASA's hearing conservation program for personnel exposed to hazardous noise from aircraft and other equipment. Some of the audiometric data from the LSAH database were recently reviewed, in order to assess trends and compare data with other population studies.

When the human ear is exposed to hazardous noise without adequate hearing protection, hearing sensitivity decreases in high frequencies that are well above the range which is most critical to understanding human speech. Because of characteristics of the human hearing system (*e.g.*, the ear canal has an acoustic resonance), NIHL is first seen as a "notch" in the audiogram around 4000 Hz. As more damage occurs, this audiometric notch deepens and eventually shifts into frequency regions that are needed for speech understanding (300-3000 Hz). The typical progressive, notching pattern of noise-induced hearing loss seen among workers exposed to 90dB every day without hearing protection is shown in Figure 1. Note that the lower end of the speech spectrum contains energy that our ear interprets as loudness, while higher frequencies in the speech spectrum

contribute to clarity, or speech understanding.

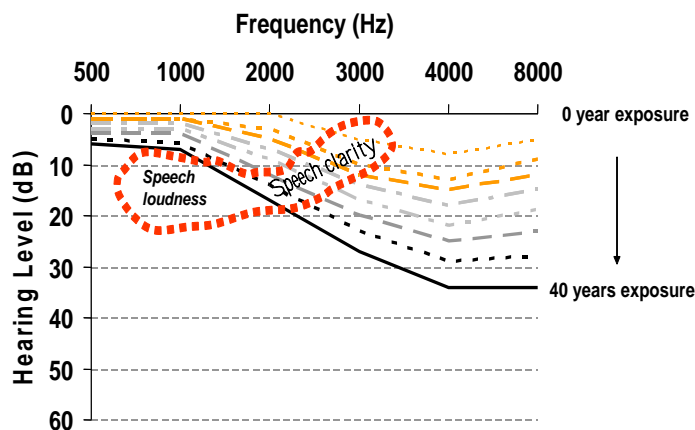
Hearing conservation programs, which include hearing protection, training, and hearing testing, have been part of NASA's occupational health program for noise-exposed personnel for decades, as well as the military's. At the request of Congress, the Institute of Medicine recently reviewed the available scientific evidence regarding the presence of NIHL and tinnitus in U.S. military personnel from World War II to 2002. A committee examined, among other things, available data on hearing loss that could be expected among military personnel. For example, they found that it is unlikely that noise exposure results in a delayed onset of hearing loss. The findings and recommendations from the review are pertinent to veterans who are members of both astronaut and comparison participants, as well as providing scientific evidence that can be applied to all noise-exposed personnel.

Formal hearing conservation efforts (*e.g.*, training in hearing protection and effects

of noise, enforcement of hearing protection use) have been aimed at all astronauts, but only for those comparison participants who worked in noise-hazardous jobs at JSC. Consequently, it would be logical to assume that the astronauts, as the target population of the conservation efforts, were more at risk for and would show more NIHL as compared to the comparison participants. However, the current analysis of LSAH data yields a rather surprising result. Figure 2 on the next page compares the mean of the audiometric thresholds for the 3000, 4000, and 6000 Hz values of LSAH participants and other populations. A hearing threshold is the lowest sound level that is detected from a specific percentage of presentations during a hearing test, so a higher value indicates less acute hearing. While hearing loss data in the comparison participants closely matched the average high frequency hearing loss for similar age groups reported for the general population (International Organization for Standardization, 1999), astronauts showed less hearing loss (in the 50 and 60 year-old age groups) than the comparison participants. When compared to a study of US Air Force personnel for the years 1975-1976 (Humes, Joellenbeck, and Durch,

2005), astronauts also had better hearing sensitivity, suggesting that close vigilance and high motivation in NASA hearing conservation programs among

**Fig 1. Progressive Hearing Loss after Exposure to 90dBA, Increments of 5 Years (as predicted by ISO1999)**



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next page*

# The NASCA Study

By **LISA MARAK, RN**  
EMR Administrator

Researchers at NASA have reported that there is a significantly increased risk of cataracts in astronauts with the greatest exposure to space radiation (see Cucinotta F. A., Manuel F. K., Jones J., Iszard G., Murray J., Djojonegoro B., Wear M. 2001. *Space radiation and cataracts in astronauts*. Radiat Res. 156(5 Pt 1): 460-6). In an effort to more precisely define the magnitude of this risk and the relationship of space radiation to cataract progression, NASA has funded a 5 year study, "The Precise Assessment of Prevalence and Progression of Lens Opacities in Astronauts as a

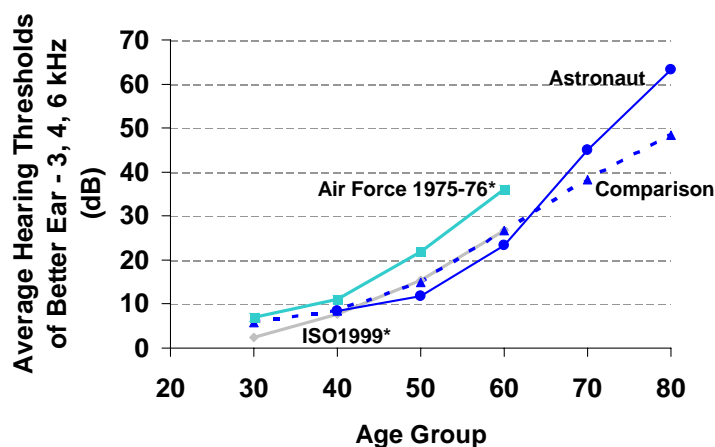
Function of Radiation Exposure During Space Flight and Development of Improved Clinical Assessment of Ocular Lens", or NASCA for short. NASCA will compare progression of cataract formation/development. The five institutions collaborating on this study are: Harvard University (Brigham & Women's Hospital), NASA, Baylor College of Medicine, Space Center Eye Associates, and Wyle Laboratories. The study is designed to measure the effect of deep space radiation on the lens of the eye, and to measure the changes in lens clarity that might develop as a result of exposure to radiation in deep space. The long term goal of this project is to improve ocular safety for astronauts during spaceflight.

The NASCA study measures the status of the lens and visual function in the astronaut population (active and retired) and two control groups: military aviators (active and retired), and people without any military aviation background. The two control groups will allow us to compare cataract risks among space radiation-exposed astronauts and non-astronauts with and without controlling for a military aviator lifestyle. Included in this study are measurements of nutritional intake, ocular exposure to sunlight and radiation exposure. Certain foods and nutrients have been linked to the development of

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*"Hearing" continued from page 2*

**Fig 2. Average Hearing Thresholds of LSAH Participants and Other Populations**



\*Data not available for age groups > 60 years old

astronauts may have yielded more effective hearing loss prevention.

However, closer inspection of Figure 2 reveals a different outcome for high frequency hearing loss in the 70 and 80 year-old age groups, where the astronauts have more hearing loss than the compar-

ison participants. These results can not be compared to that of the ISO-1999 standard population, as there are no data reported for these age groups. These findings are intriguing, since they differ from those seen in earlier age groups. One possible explanation is that astronauts in these groups were exposed to noise when

hearing conservation programs did not exist or were very primitive prior to 1970 (Humes, Joellenbeck, and Durch, 2005). As a result, the current hearing losses among these individuals may have been accelerated by early NIHL, when hearing conservation efforts, now more rigidly enforced, were not effective. Whatever the basis for these audiometric results, it is clear that hearing loss prevention is vital to PROTECTING remaining hearing function. All LSAH participants are urged to use appropriate hearing protection consistently when using noise-hazardous equipment or when firing weapons, at work or at home. ■

## References:

International Organization for Standardization. 1999. *Acoustics – determination of occupational noise exposure and estimation of noise-induced hearing impairment*. International Standard ISO 1999:1990 (E).

Humes LE, Joellenbeck LM, and Durch JS. 2005. *Noise and military service: Implications for hearing loss and tinnitus*. Washington DC: National Academies Press.

# What is a DXA Scan?

By **BABY DJOJONEGORO, MS, MPH**

**D**XA stands for Dual energy X-ray Absorptiometry. The DXA scan is a non-intrusive procedure used to measure bone mineral density (BMD) using low energy x-rays. This procedure is different from a bone scan which is used to detect subtle fractures or other bone problems, and involves an injection of gamma-radiation emitting tracers into the patient's bloodstream.

The DXA machine directs two x-rays of differing energies on to a patient, resulting in a digital image of the patient's bones. The bone mineral density is determined by calculating the absorption of the two rays by the bone and the bone area (which

approximates bone volume) and its unit is g/cm<sup>2</sup>. The resulting value is compared to the sex-matched average 30-year old standard (which shows peak BMD) and to the sex-, age- and weight- matched average to obtain the T- and Z- scores, respectively. The unit used in these scores is standard deviation. A T-score of greater than -1 means that the patient has a bone density that is less than one standard deviation less than the peak value, or normal bone density. When the T-score is between -1 and -2.5, the patient shows osteopenia, which may lead to osteoporosis. Osteoporosis is diagnosed when the T-score is below -2.5. The Z-score gives additional diagnostic information; a value of less than -1.5 may lead to more tests to determine the cause for the patient's low bone density as compared to his/her peers. ■

*"NASCA" continued from page 3*

cataracts, so this vital information is gathered every year during the study period. We have concluded the first year of the five year study, and the researchers have begun analyzing all of the data collected to date. The data will be published in recognized ophthalmology journals beginning in the Fall of 2006.

We are still recruiting into this study, with a focus on our military aviation group, particularly female pilots. When you call you will be asked a series of medical questions (exclusion criteria) to determine eligibility. Once invited, you will undergo a thorough vision exam onsite at JSC (performed by Space Center Eye Associates), as well as complete a series of questionnaires. Measurements of height, weight and blood pressure will also be obtained as a part of the routine data collection. If you are interested in participating in this five year study, please contact Lisa Marak, RN at 281-244-5183. ■

*"Medical Research" continued from page 1*

more evidence is available, we will not be as surprised should a follow-up study contradict a previous one.

Given the lack of continuity in reporting, we usually have to consult other sources to get a bigger picture of the issue. A reputable source is the Cochrane Library, a quarterly publication which reviews and summarizes current healthcare interventions. The Cochrane Library is produced by the Cochrane Collaboration, an international non-profit and independent organization which was created to produce and

distribute up-to-date and accurate information on healthcare interventions worldwide, and to promote evidence-based medical research. Abstracts of the reviews are provided free of charge to U.S. residents on the Cochrane Library website ([www.thecochranelibrary.com](http://www.thecochranelibrary.com)), including plain language summaries when available. Current JSC employees and contractors also have access to all of the contents in the Cochrane Library through the JSC Scientific and Technical Information Center subscription. From the JSC homepage click on the STI Center (Library) link, then click on the

Electronic Resources link (on the red menu bar), select the A to Z Database List, and lastly click on the Cochrane Library link.

Armed with this knowledge, we will not treat the next medical breakthrough trumpeted by the media as a panacea, but instead apply some skepticism until we review the body of evidence for it. ■

## For your information

If you want a copy of your exam results, please complete and sign a release form while you are visiting the Clinic for your examination. The form is called *Privacy Act Disclosure Authorization and Accounting Record (DAAR)*, or NASA Form 1536.

## ...and ours

If you have a new address or phone number, please let us know by calling (281) 244-5195 or (281) 483-7999. You may also write us at:

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